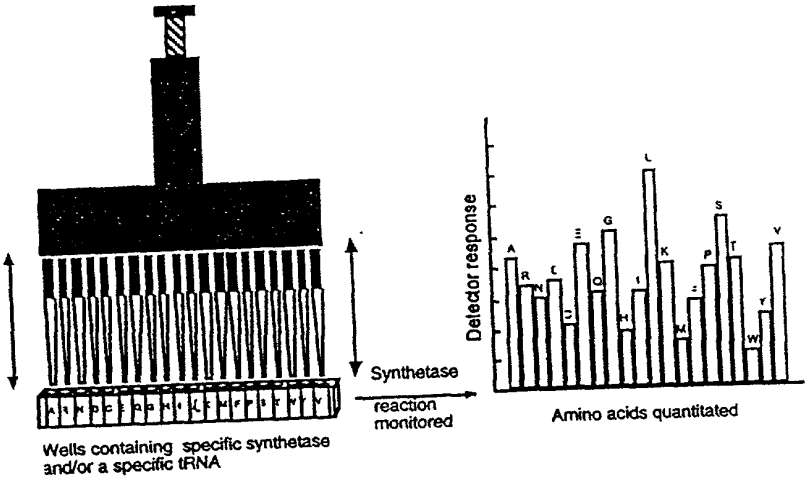

Wells containing specific synthetase and/or a specific tRNA
Synthetase
reaction monitored
Detector response
Amino acids quantitated

FIG. 1A

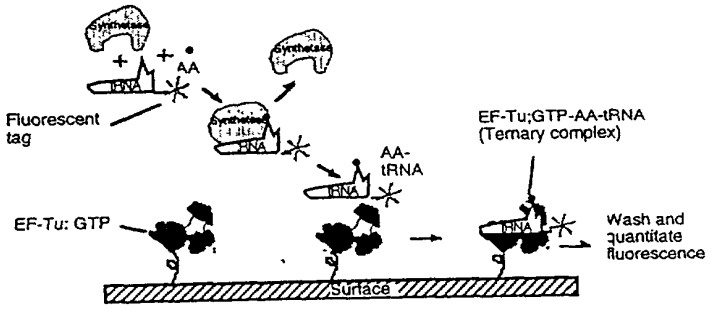

Synthetase
AA
tRNA
Fluorescent tag
EF-Tu;GTP-AA-tRNA (Ternary complex)
AA-tRNA
EF-Tu: GTP
Wash and quantitate fluorescence
Surface

FIG. 1B

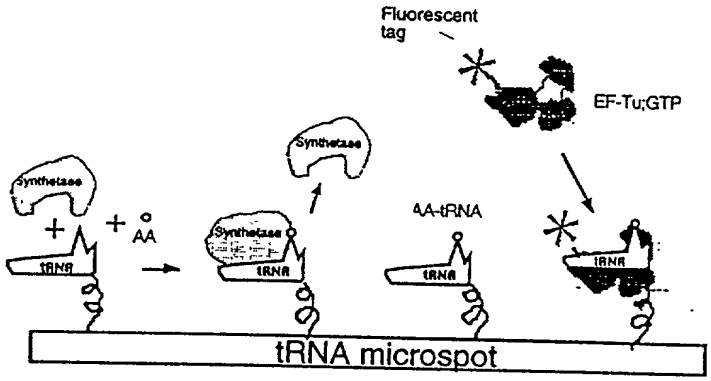

Fluorescent tag
EF-Tu:GTP
Synthetase
AA
tRNA
AA-tRNA
tRNA microspot

FIG. 2A

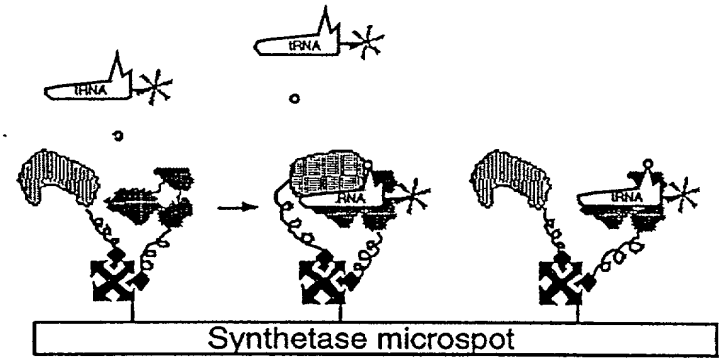

tRNA
Synthetase microspot

FIG. 2B

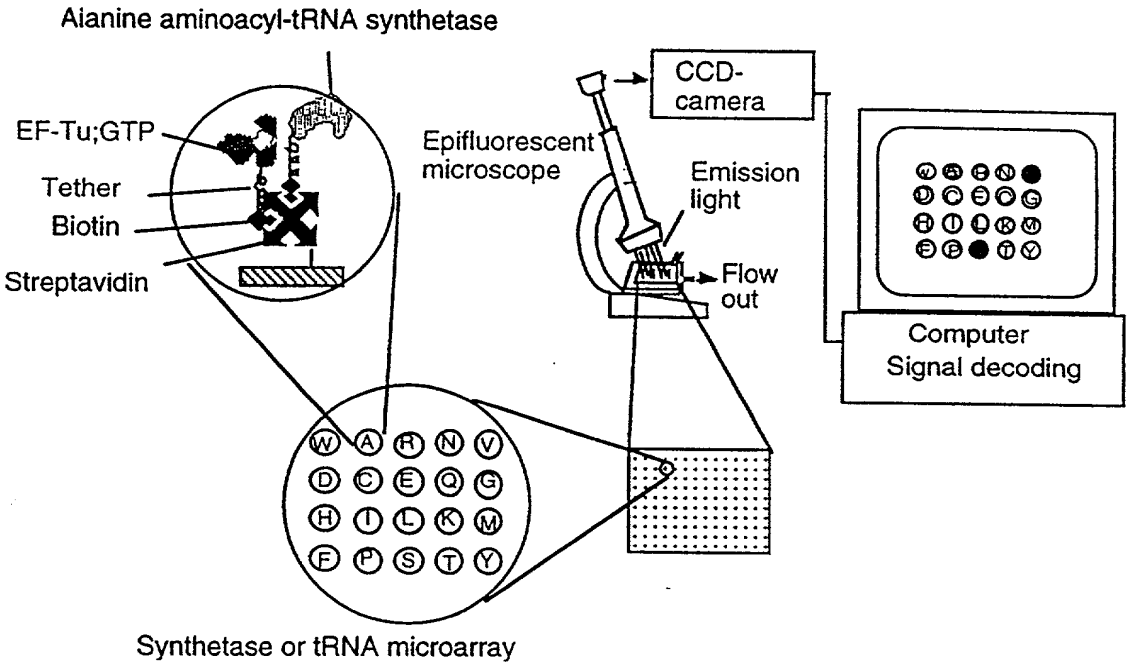

Alanine aminoacyl-tRNA synthetase
EF-Tu;GTP
Tether
Biotin
Streptavidin
CCD-camera
Epifluorescent microscope
Emission light
Flow out
Computer
Signal decoding
Synthetase or tRNA microarray

FIG. 3

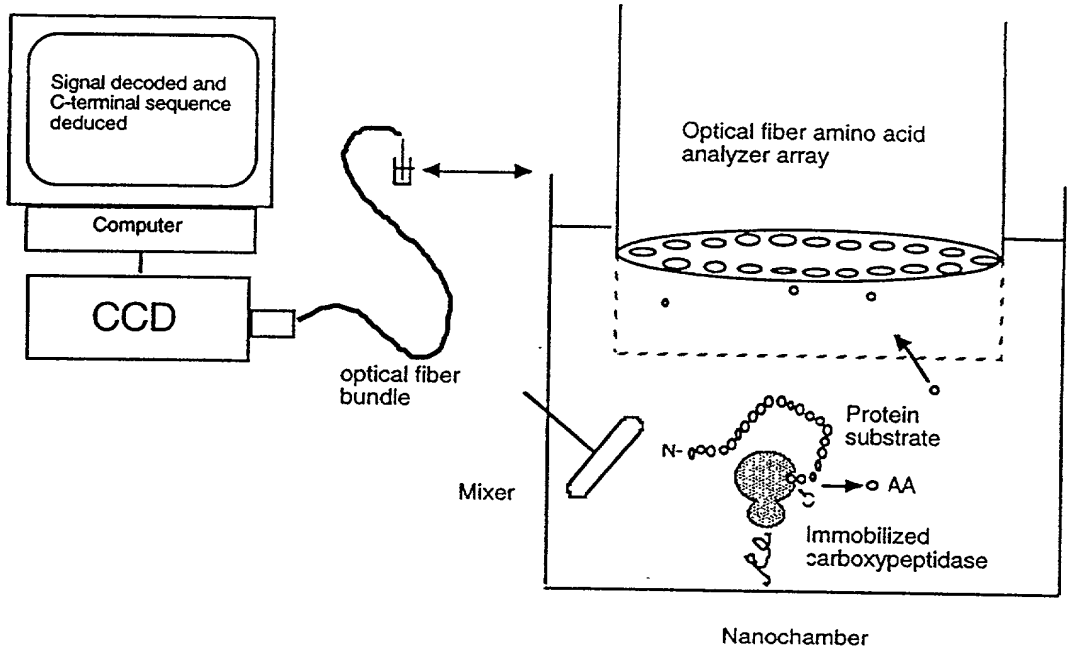

Signal decoded and
C-terminal sequence
deduced
Computer
CCD
optical fiber
bundle
Optical fiber amino acid
analyzer array
Protein
substrate
N-
AA
C
Mixer
Immobilized
carboxypeptidase
Nanochamber

FIG. 4

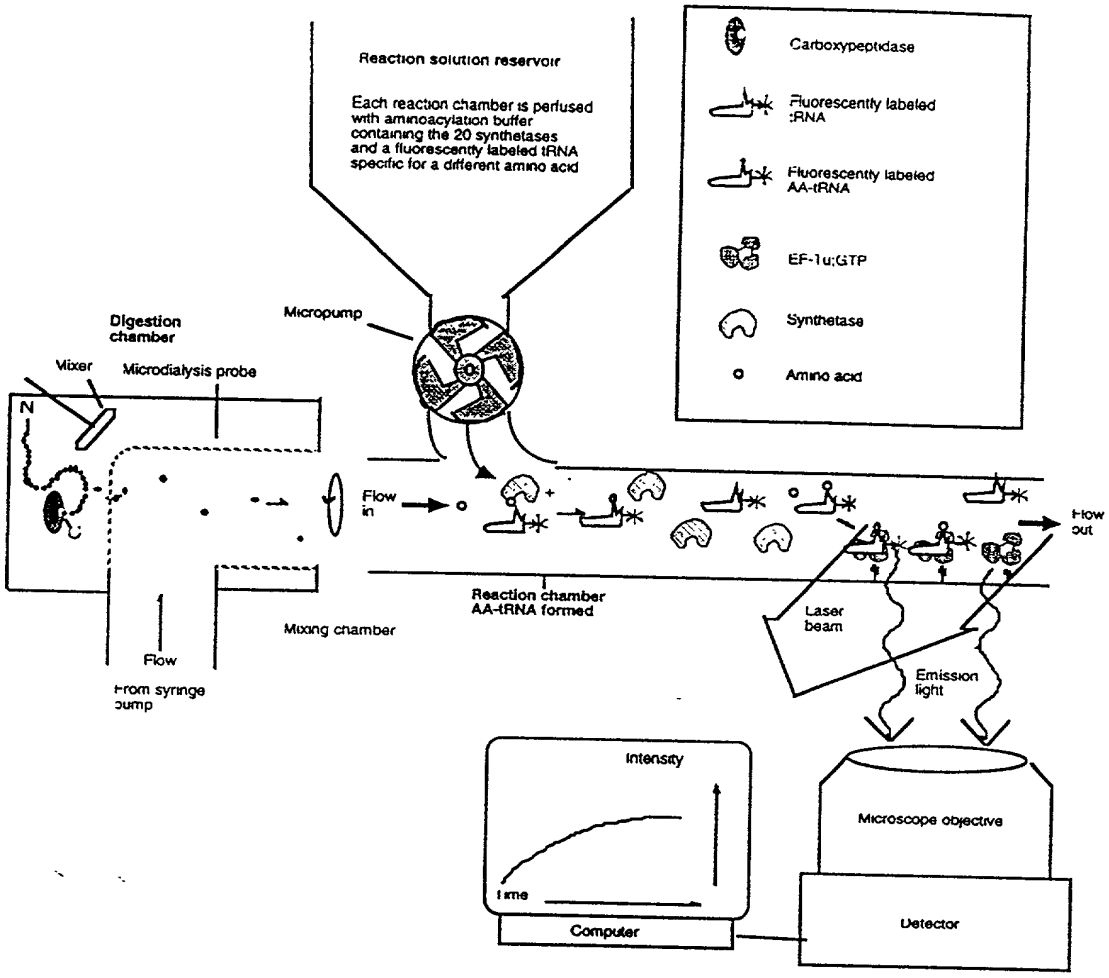

Reaction solution reservoir
Each reaction chamber is perfused with aminoacylation buffer containing the 20 synthetases and a fluorescently labeled tRNA specific for a different amino acid
Carboxypeptidase
Fluorescently labeled tRNA
Fluorescently labeled AA-tRNA
EF-1u:GTP
Synthetase
Amino acid
Micropump
Digestion chamber
Mixer
Microdialysis probe
N
Flow in
Flow out
Reaction chamber
AA-tRNA formed
Mixing chamber
Flow
From syringe pump
Laser beam
Emission light
Intensity
Time
Computer
Microscope objective
Detector

FIG. 5A

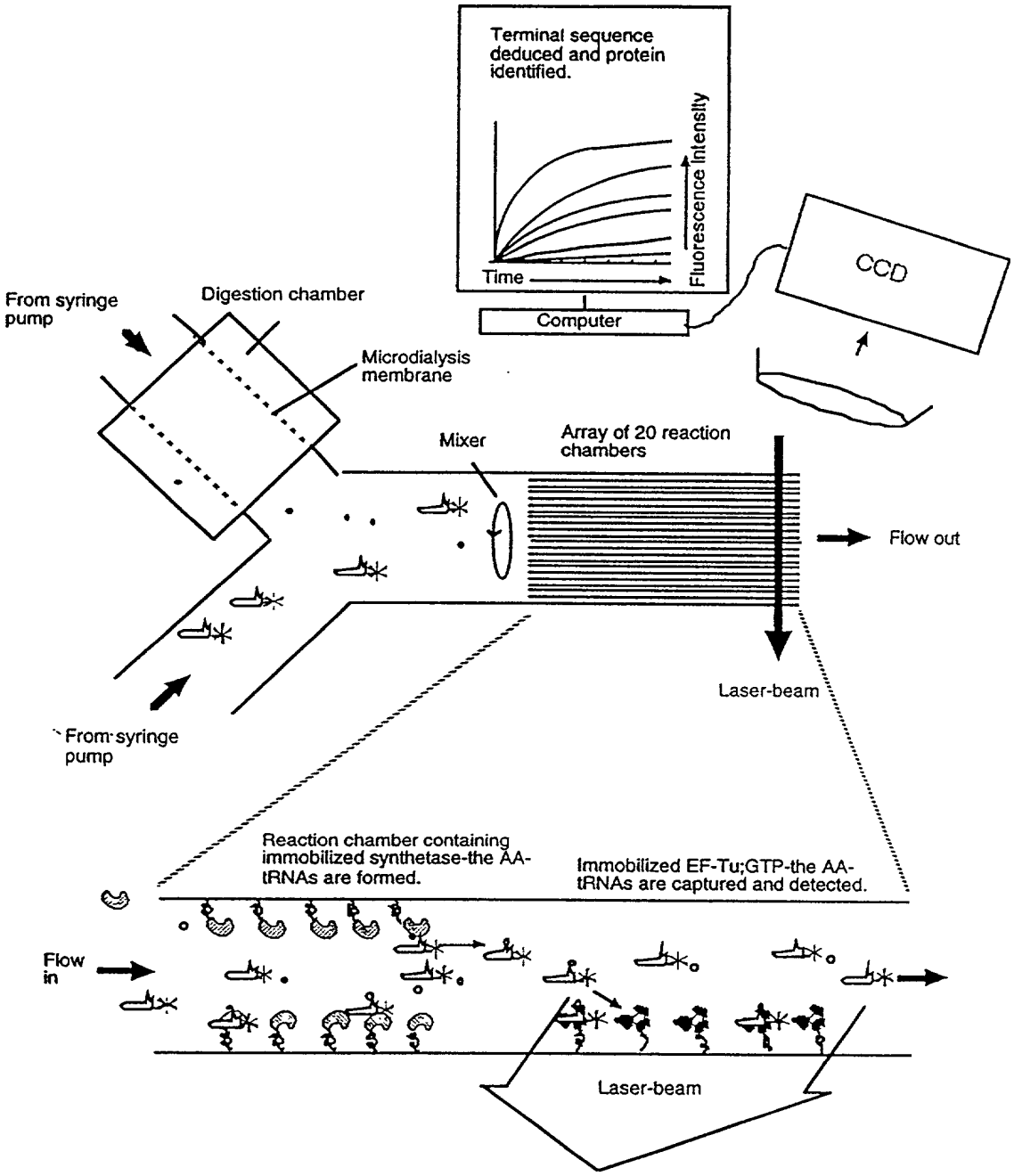

Terminal sequence deduced and protein identified.
Fluorescence Intensity
Time
Computer
CCD
From syringe pump
Digestion chamber
Microdialysis membrane
Mixer
Array of 20 reaction chambers
Flow out
Laser-beam
From syringe pump
Reaction chamber containing immobilized synthetase-the AA-tRNAs are formed.
Immobilized EF-Tu;GTP-the AA-tRNAs are captured and detected.
Flow in
Laser-beam

FIG. 5B

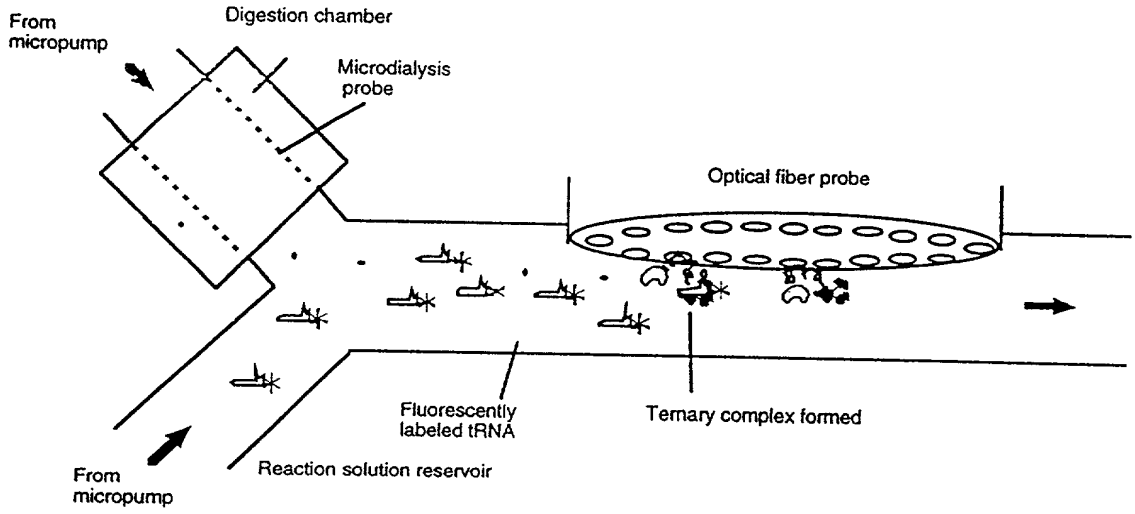

From micropump
Digestion chamber
Microdialysis probe
Optical fiber probe
Fluorescently labeled tRNA
Ternary complex formed
From micropump
Reaction solution reservoir

FIG. 5C

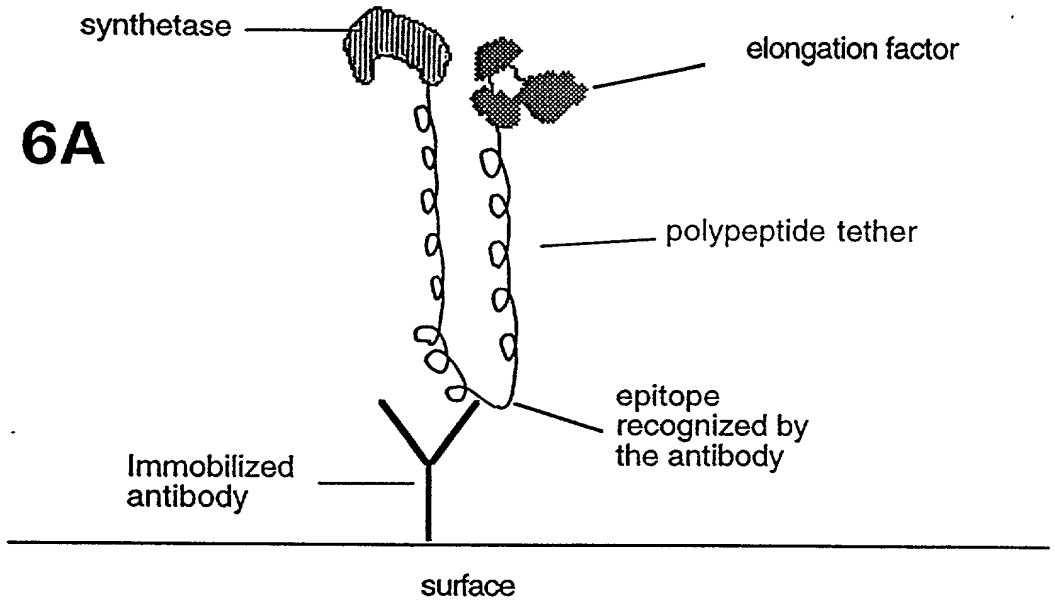

synthetase
elongation factor
polypeptide tether
epitope recognized by the antibody
Immobilized antibody
surface

FIG. 6A

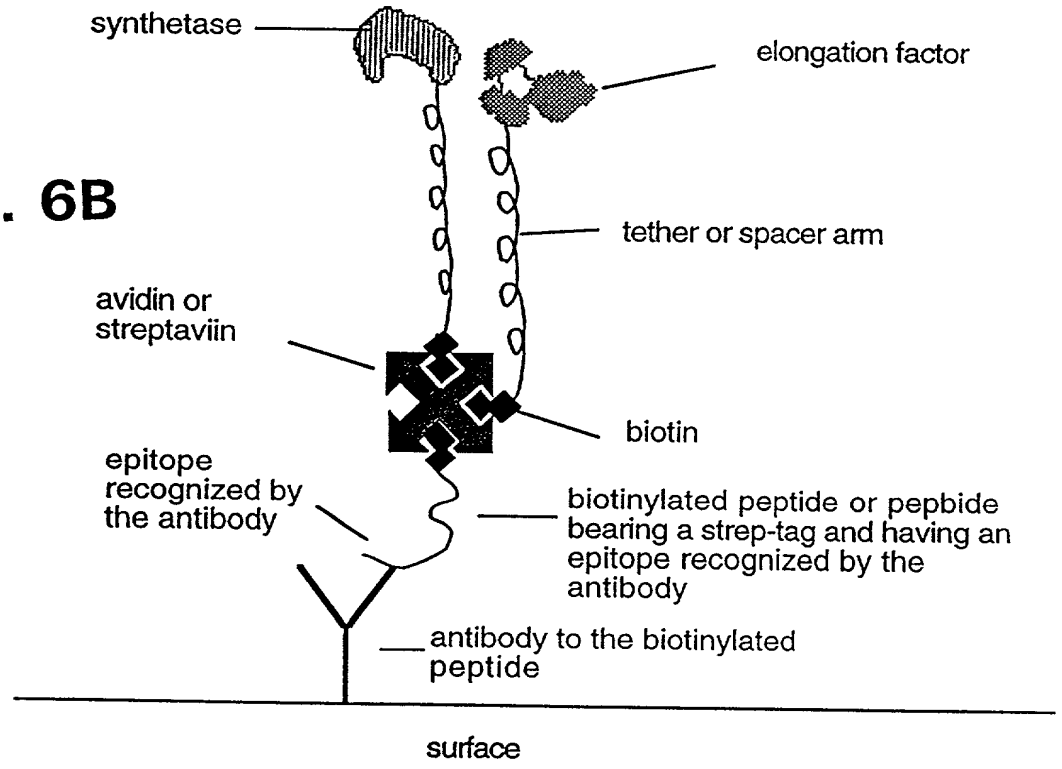

synthetase
elongation factor
tether or spacer arm
avidin or streptaviin
biotin
epitope recognized by the antibody
biotinylated peptide or pepbide bearing a strep-tag and having an epitope recognized by the antibody
antibody to the biotinylated peptide
surface

FIG. 6B

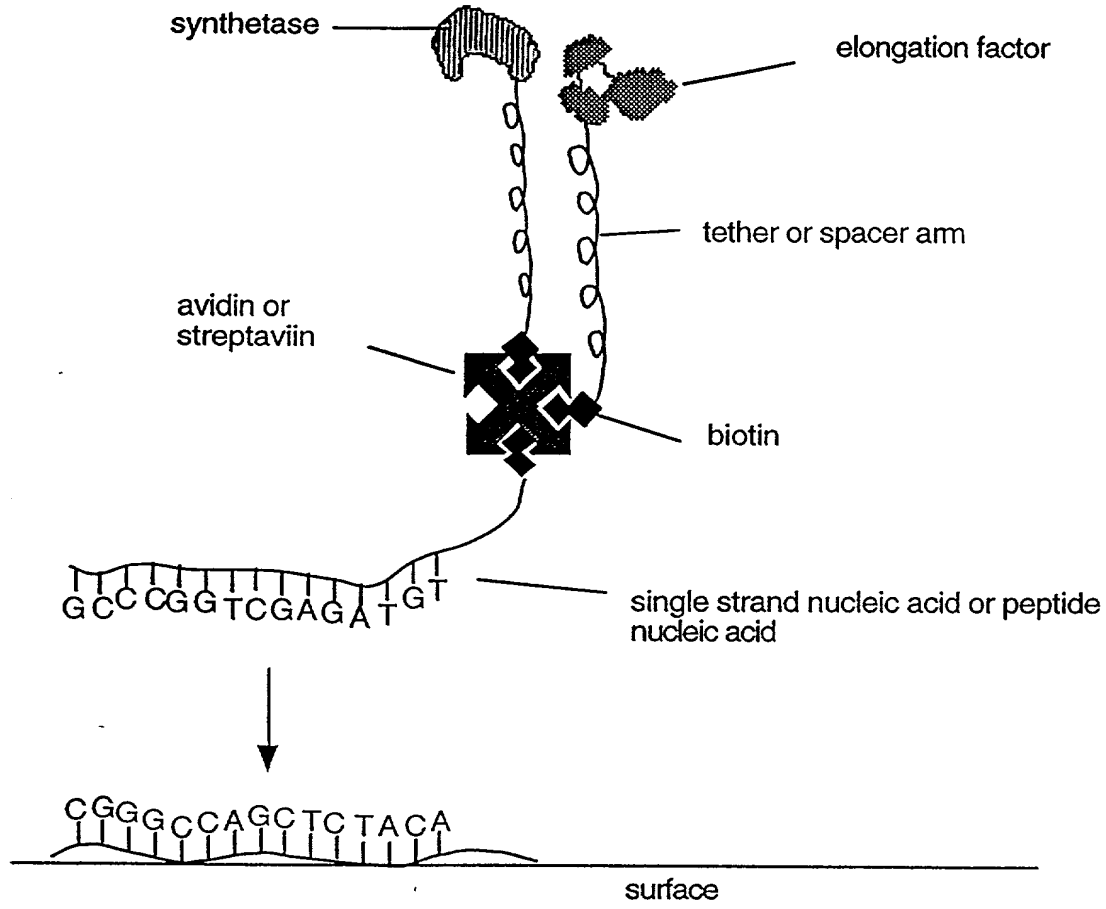

synthetase
elongation factor
tether or spacer arm
avidin or
streptaviin
biotin
GCCCGGTCGAGATGT
single strand nucleic acid or peptide
nucleic acid
CGGGCCAGCTCTACA
surface

FIG. 6C

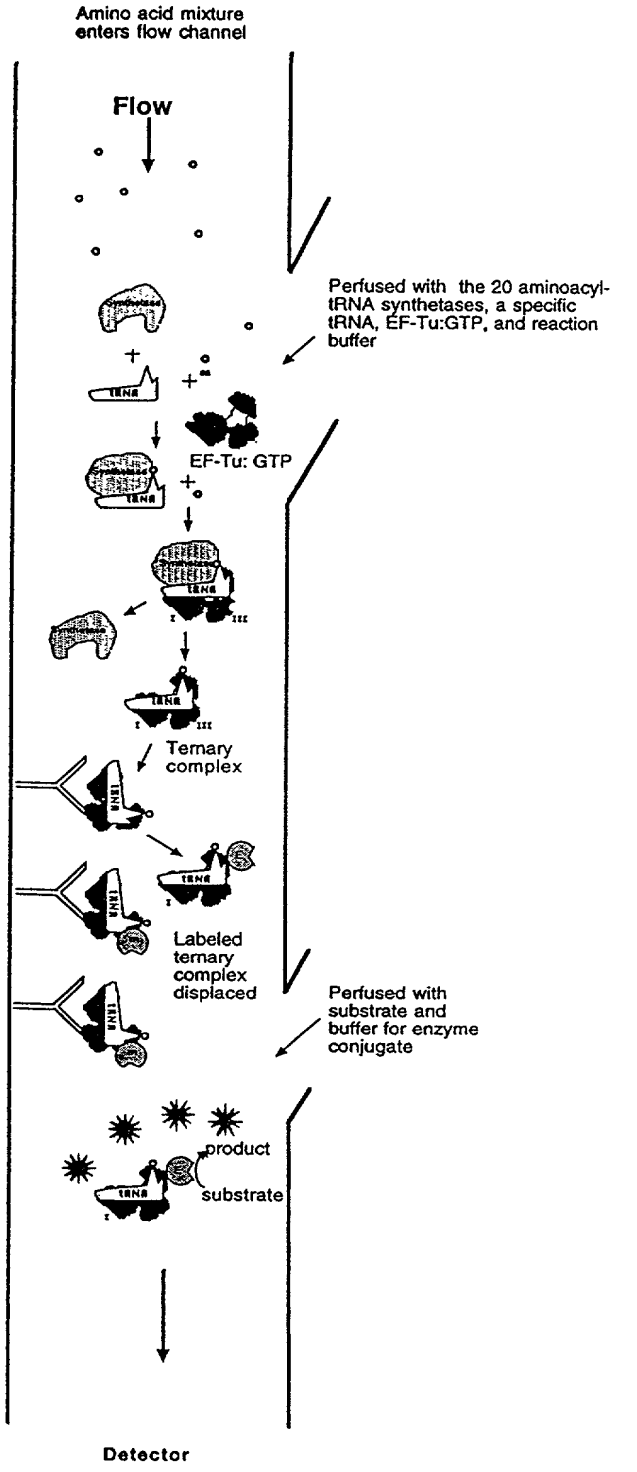

Amino acid mixture enters flow channel
Flow
Perfused with the 20 aminoacyl-tRNA synthetases, a specific tRNA, EF-Tu:GTP, and reaction buffer
EF-Tu: GTP
Ternary complex
Labeled ternary complex displaced
Perfused with substrate and buffer for enzyme conjugate
product
substrate
Detector

FIG. 7A

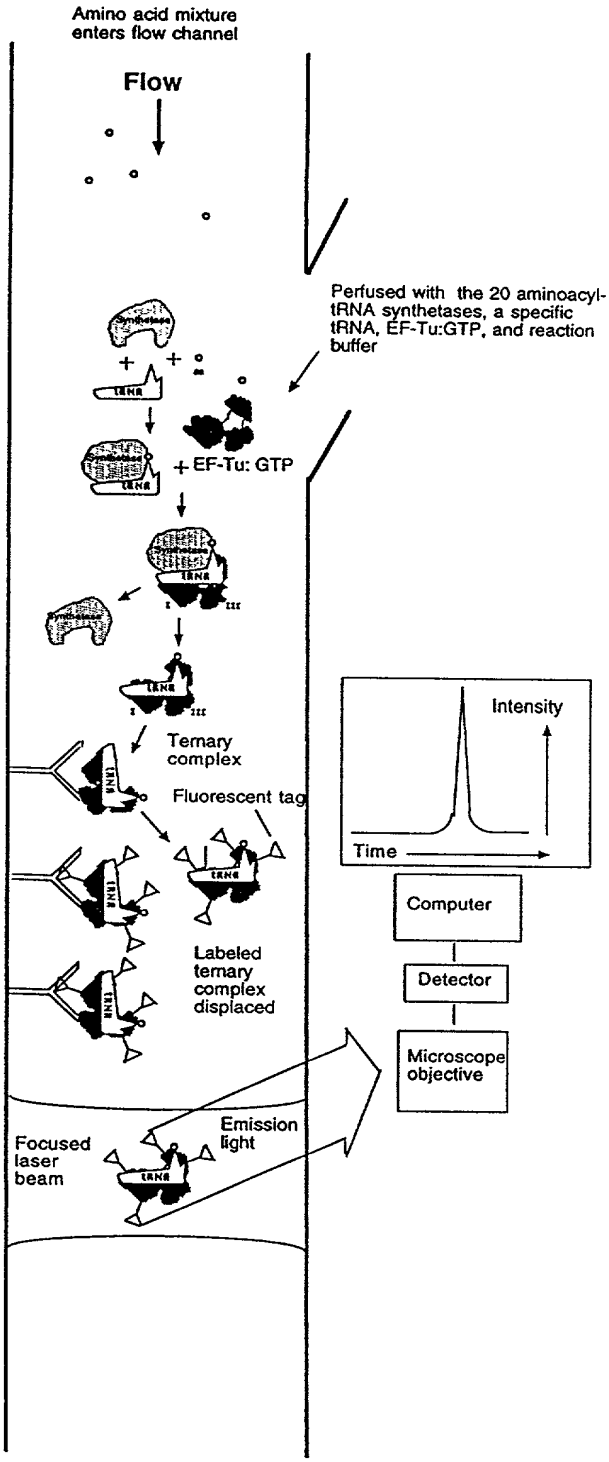

Amino acid mixture enters flow channel
Flow
Perfused with the 20 aminoacyl-tRNA synthetases, a specific tRNA, EF-Tu:GTP, and reaction buffer
EF-Tu: GTP
Ternary complex
Fluorescent tag
Labeled ternary complex displaced
Focused laser beam
Emission light
Intensity
Time
Computer
Detector
Microscope objective

FIG. 7B

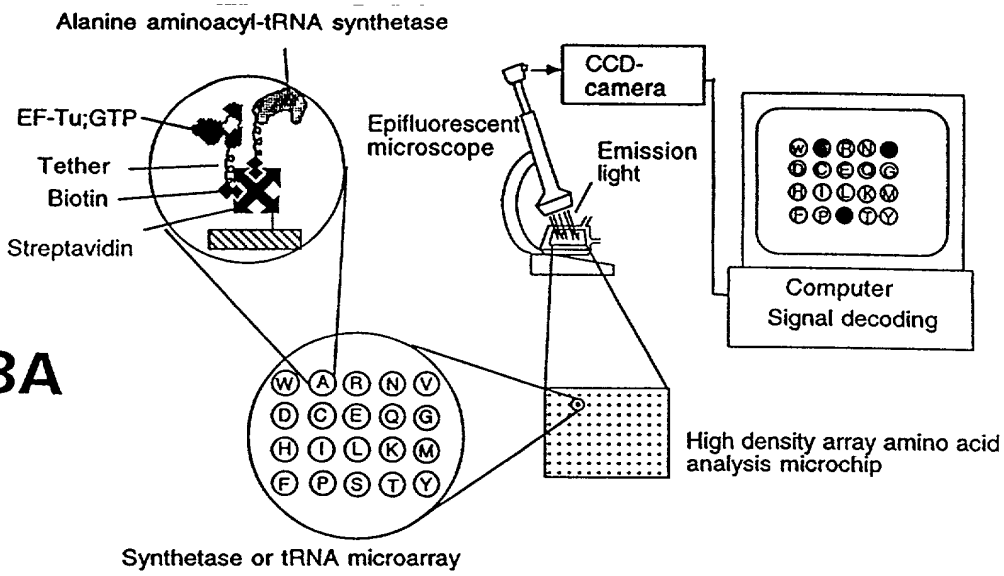


FIG. 8A

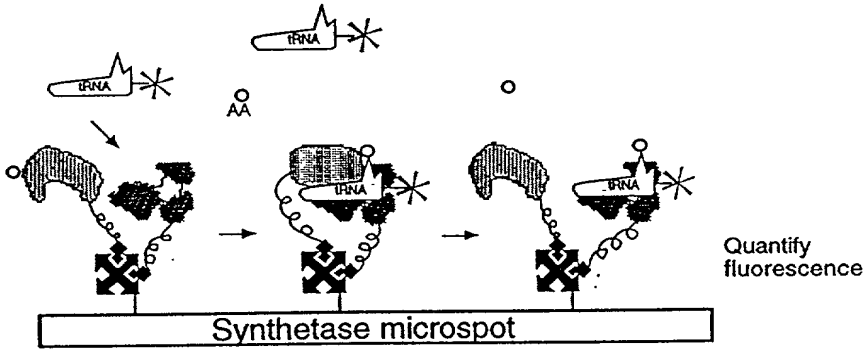


FIG. 8B

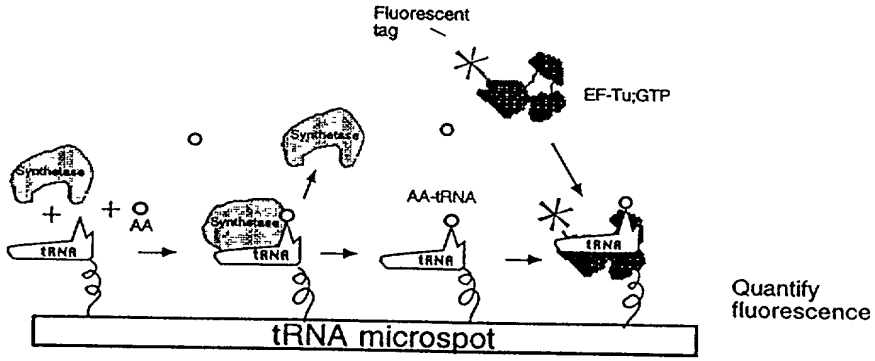
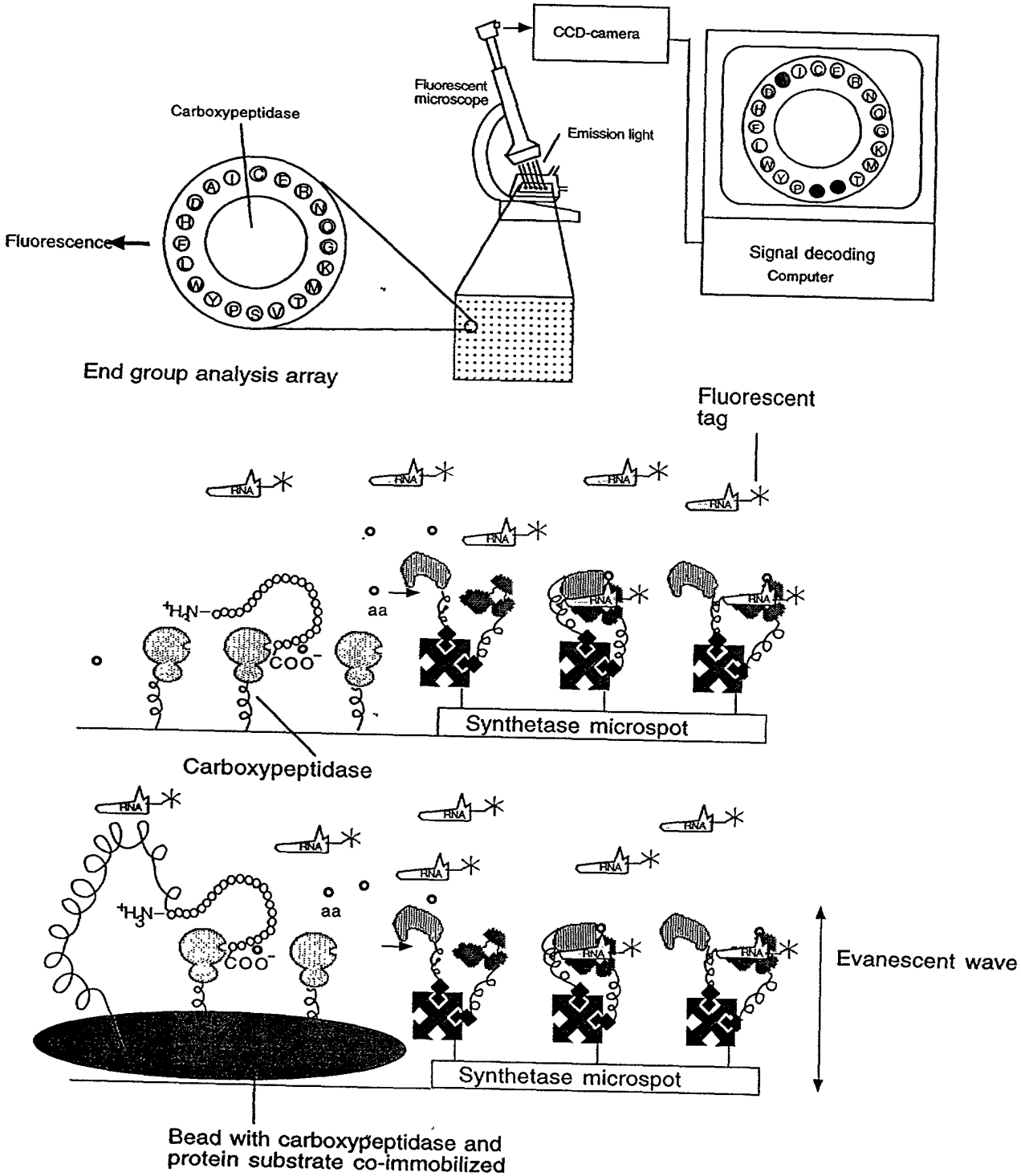


FIG. 8C

Fig.8D


CCD-camera
Fluorescent microscope
Carboxypeptidase
Emission light
Fluorescence
Signal decoding
Computer
End group analysis array
Fluorescent tag
RNA
aa
Synthetase microspot
Carboxypeptidase
Evanescent wave
Bead with carboxypeptidase and protein substrate co-immobilized

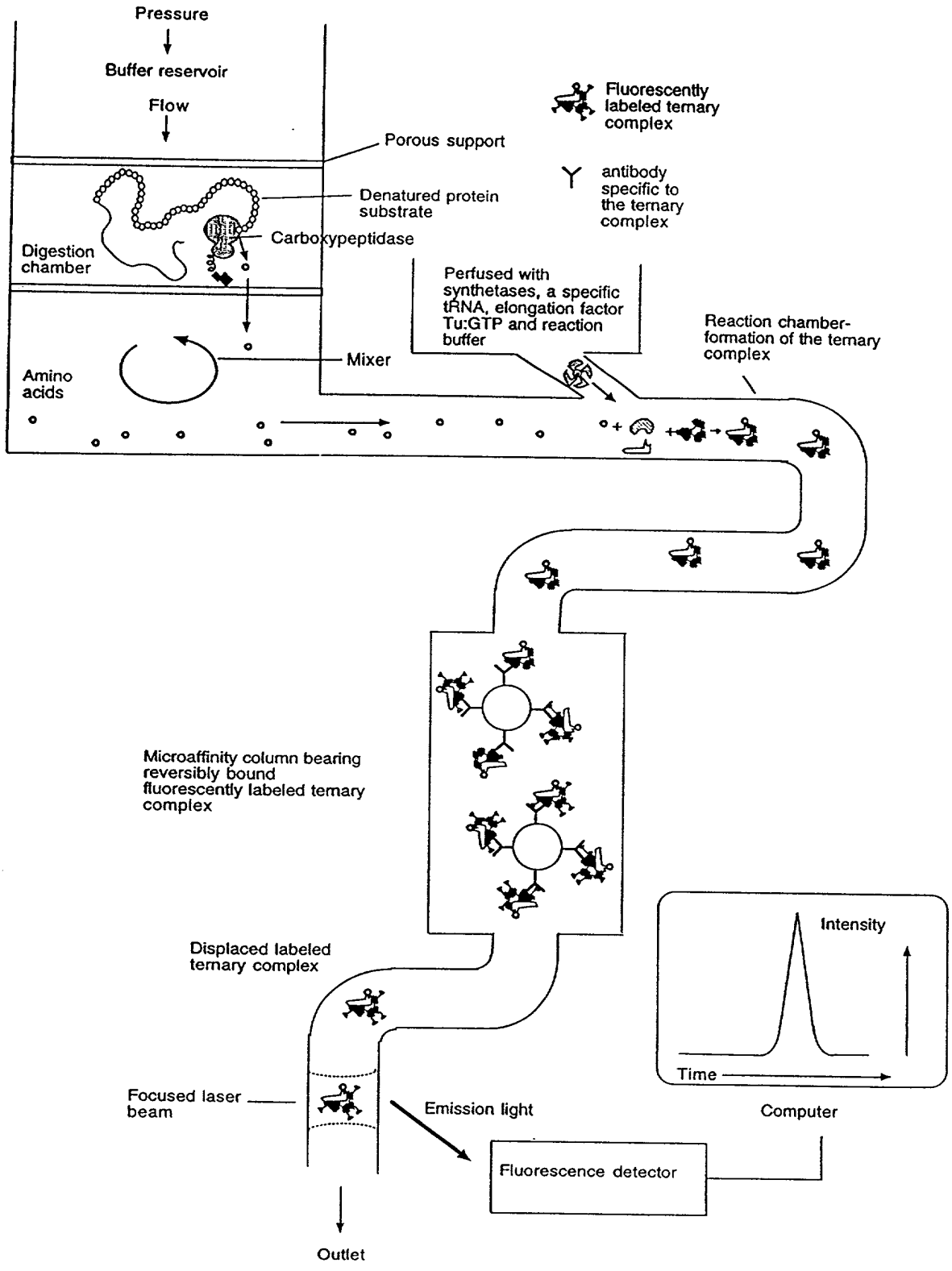

Pressure
Buffer reservoir
Flow
Porous support
Fluorescently labeled ternary complex
antibody specific to the ternary complex
Denatured protein substrate
Carboxypeptidase
Digestion chamber
Perfused with synthetases, a specific tRNA, elongation factor Tu:GTP and reaction buffer
Reaction chamber-formation of the ternary complex
Mixer
Amino acids
Microaffinity column bearing reversibly bound fluorescently labeled ternary complex
Displaced labeled ternary complex
Intensity
Time
Computer
Focused laser beam
Emission light
Fluorescence detector
Outlet

FIG. 9

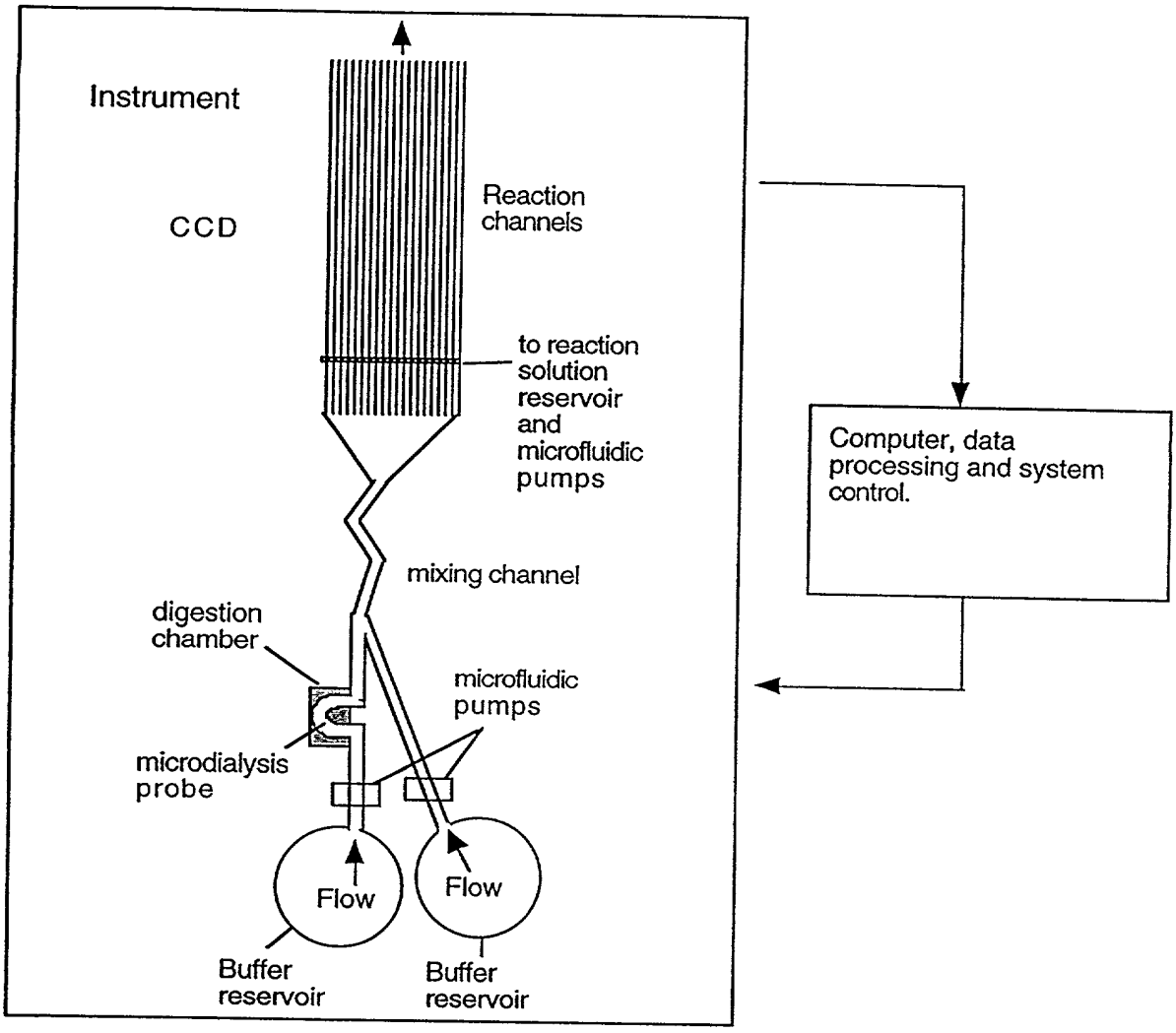
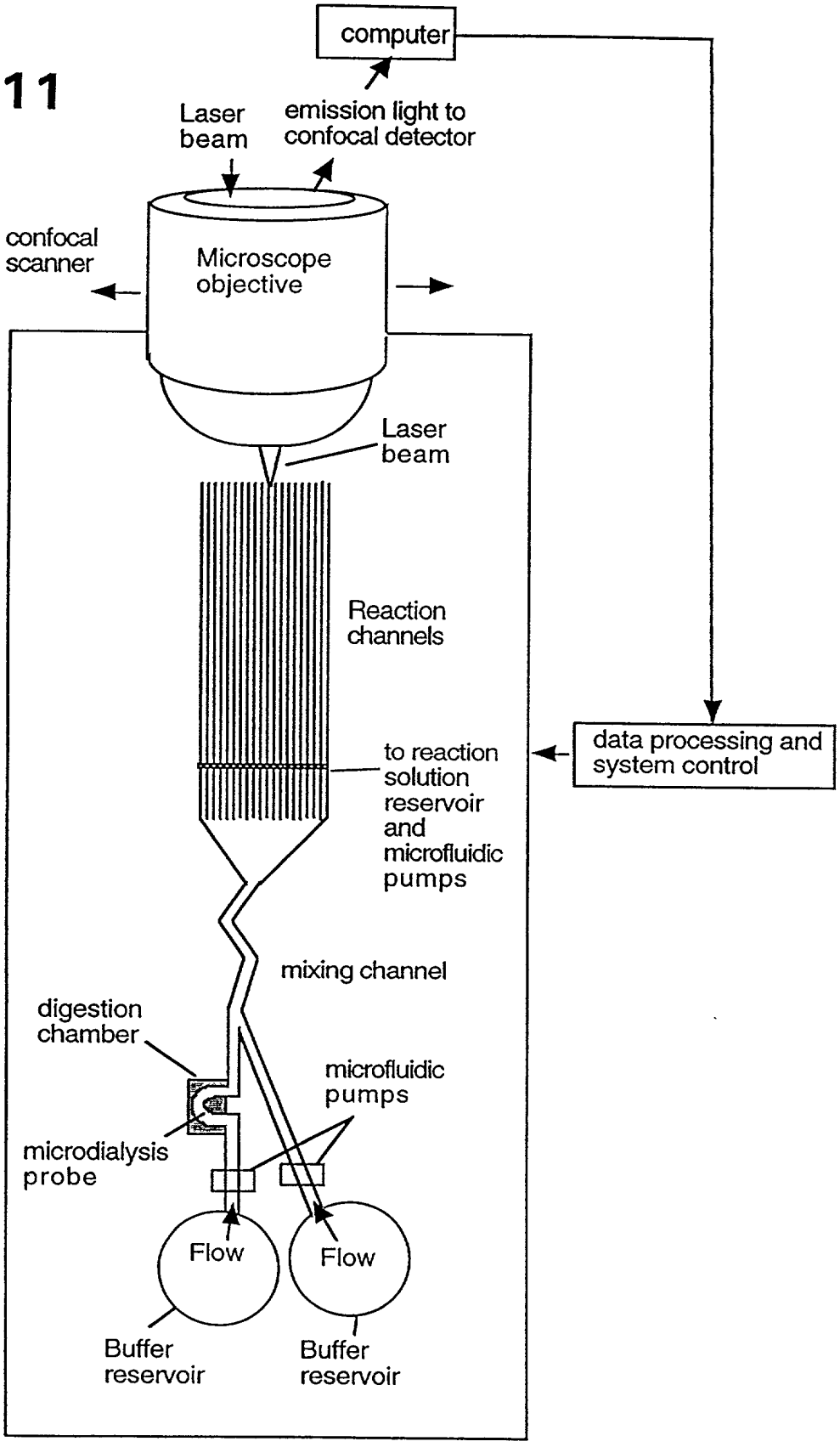

Instrument
CCD
Reaction channels
to reaction solution reservoir and microfluidic pumps
mixing channel
digestion chamber
microfluidic pumps
microdialysis probe
Flow
Flow
Buffer reservoir
Buffer reservoir
Computer, data processing and system control.

FIG. 10

FIG. 11


computer
Laser beam
emission light to confocal detector
confocal scanner
Microscope objective
Laser beam
Reaction channels
to reaction solution reservoir and microfluidic pumps
data processing and system control
mixing channel
digestion chamber
microfluidic pumps
microdialysis probe
Flow
Flow
Buffer reservoir
Buffer reservoir

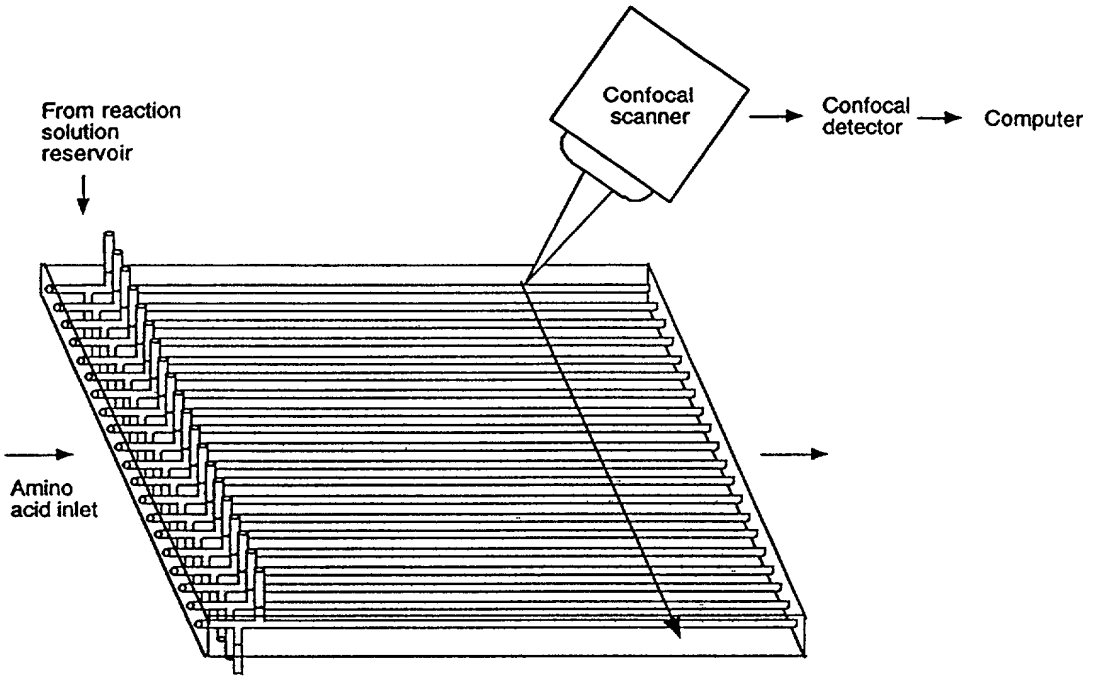


FIG. 12A

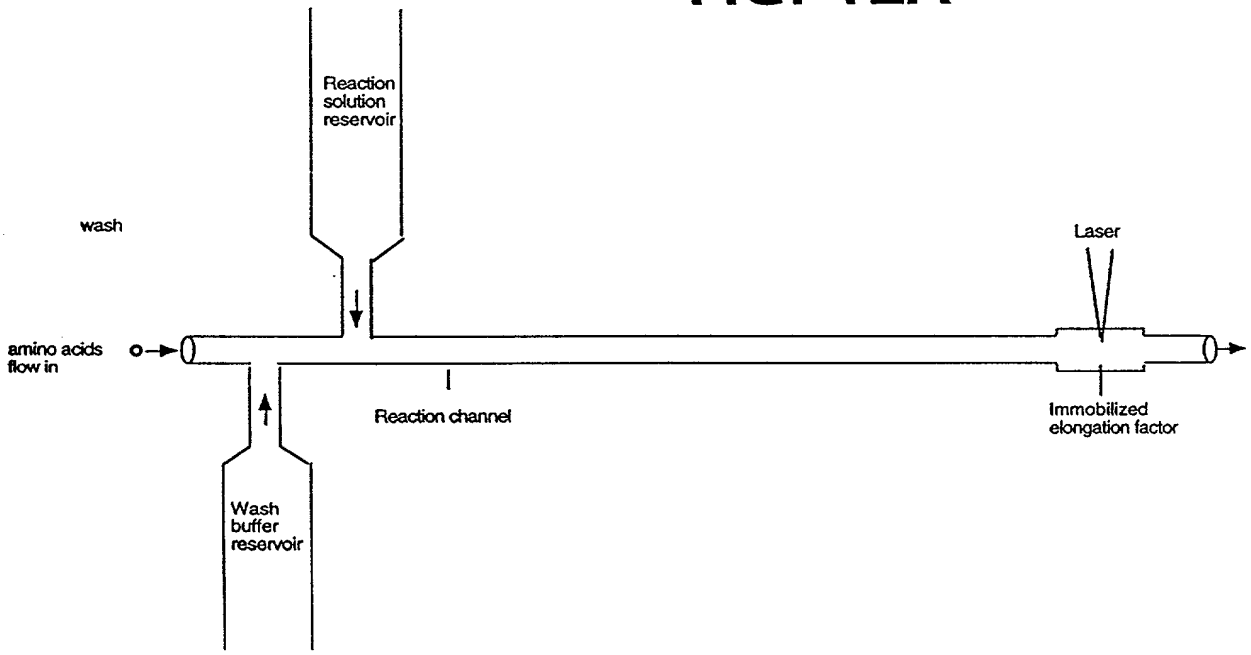


FIG. 12B

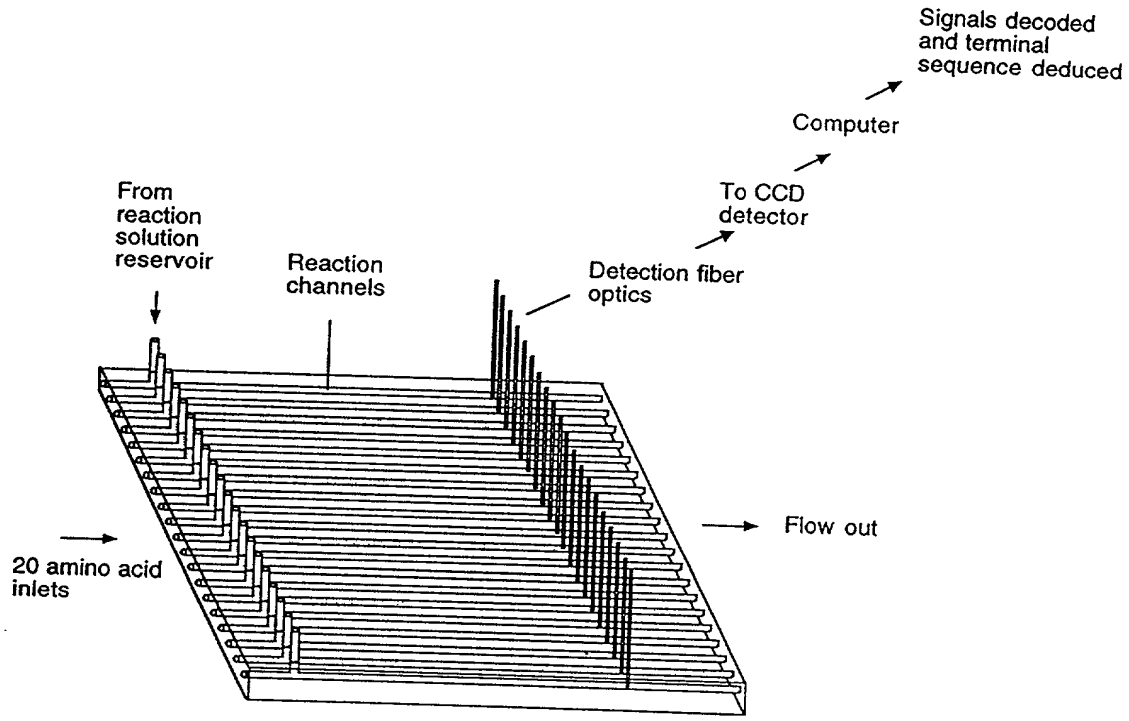

Signals decoded and terminal sequence deduced
Computer
To CCD detector
From reaction solution reservoir
Reaction channels
Detection fiber optics
Flow out
20 amino acid inlets

FIG. 12C

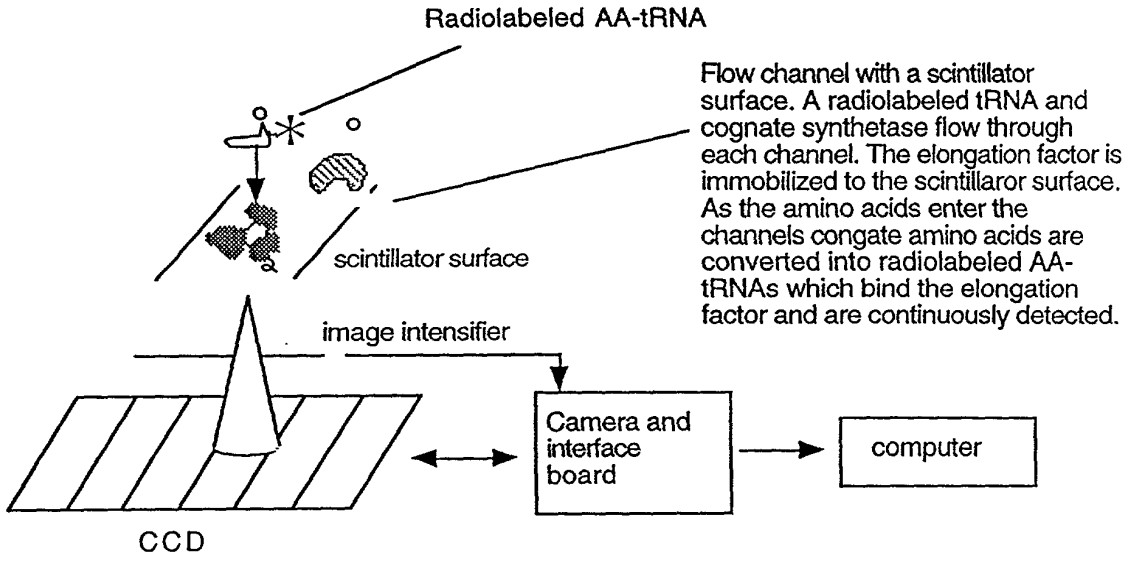


FIG. 13A

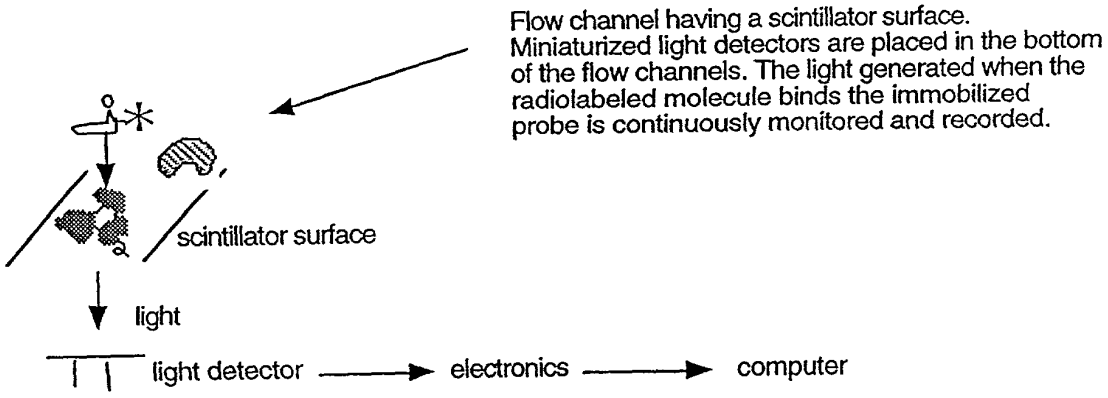


FIG. 13B

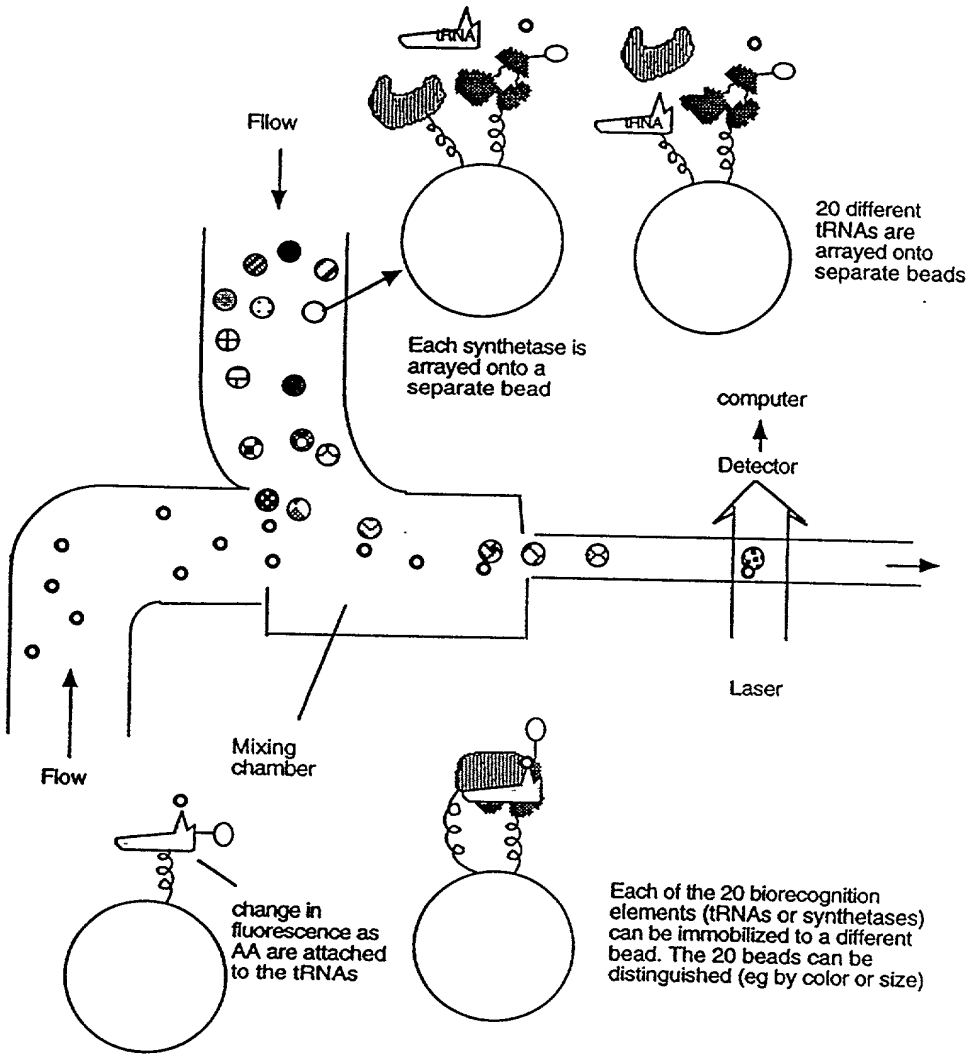

tRNA
tRNA
Flow
20 different tRNAs are arrayed onto separate beads
Each synthetase is arrayed onto a separate bead
computer
Detector
Laser
Flow
Mixing chamber
change in fluorescence as AA are attached to the tRNAs
Each of the 20 biorecognition elements (tRNAs or synthetases) can be immobilized to a different bead. The 20 beads can be distinguished (eg by color or size)

FIG. 14

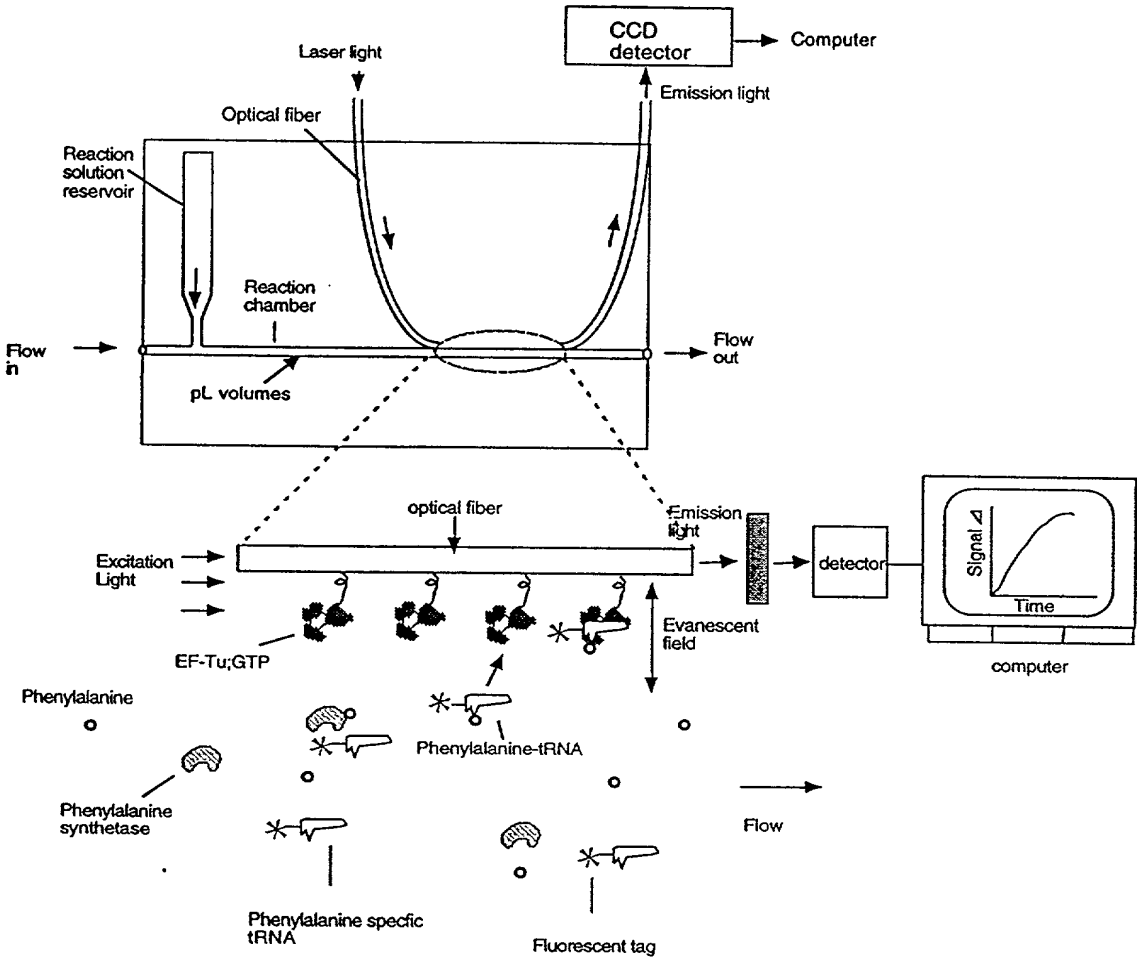

CCD detector
Computer
Laser light
Emission light
Optical fiber
Reaction solution reservoir
Reaction chamber
Flow in
Flow out
pL volumes
optical fiber
Emission light
Excitation Light
detector
Signal
Time
computer
Evanescent field
EF-Tu;GTP
Phenylalanine
Phenylalanine-tRNA
Phenylalanine synthetase
Flow
Phenylalanine specfic tRNA
Fluorescent tag

FIG. 15

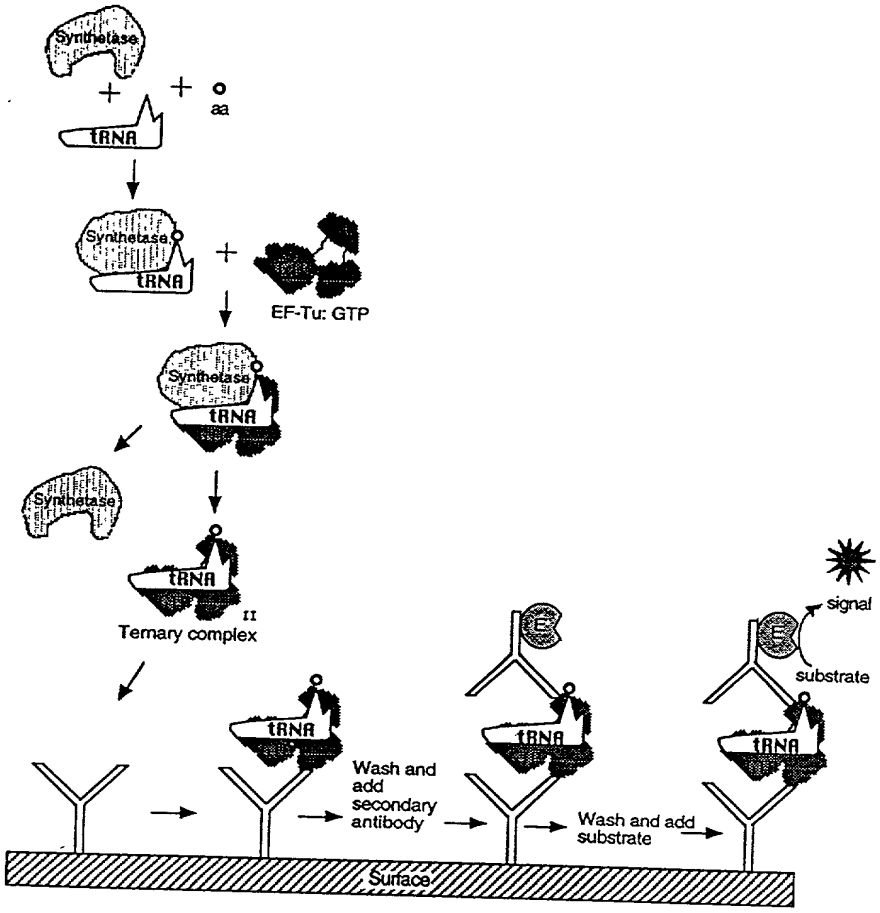

Synthetase
tRNA
aa
EF-Tu: GTP
Ternary complex
II
signal
substrate
Wash and add secondary antibody
Wash and add substrate
Surface

FIG. 16

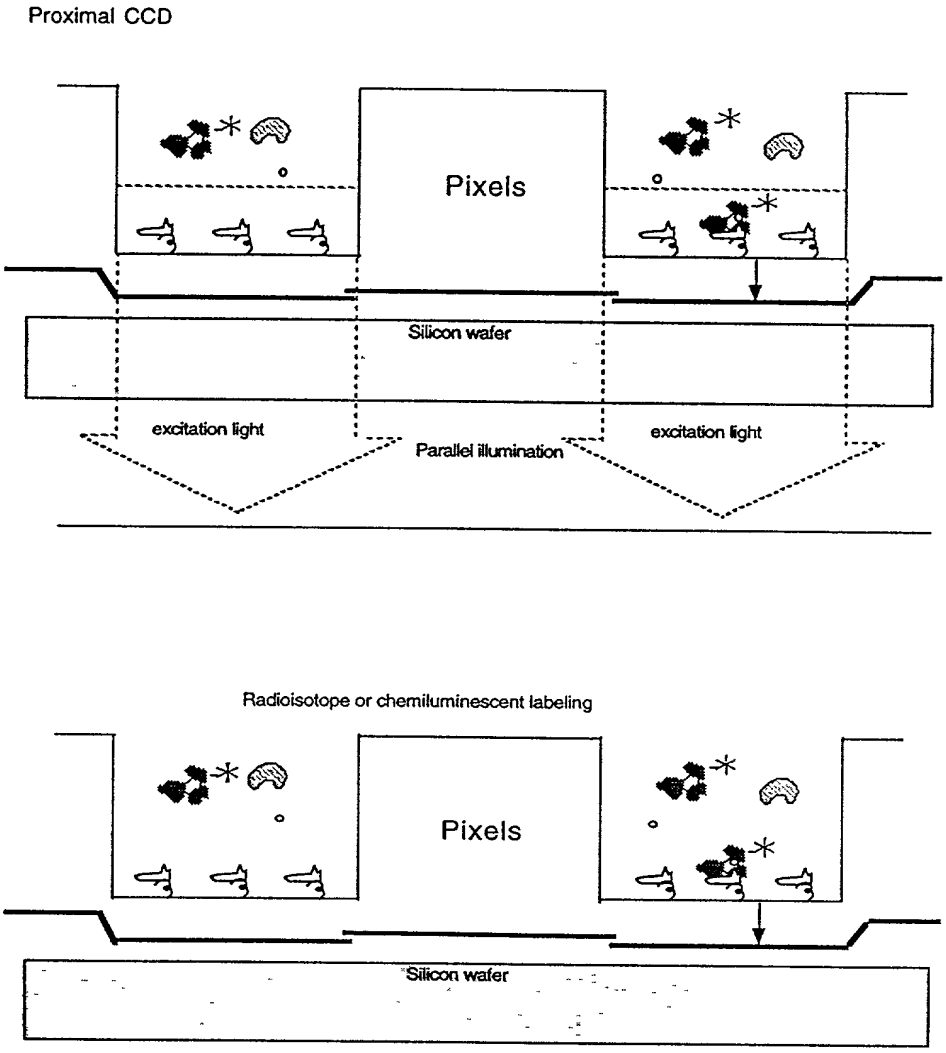

Proximal CCD
Pixels
Silicon wafer
excitation light
Parallel illumination
excitation light
Radioisotope or chemiluminescent labeling
Pixels
Silicon wafer

FIG. 17

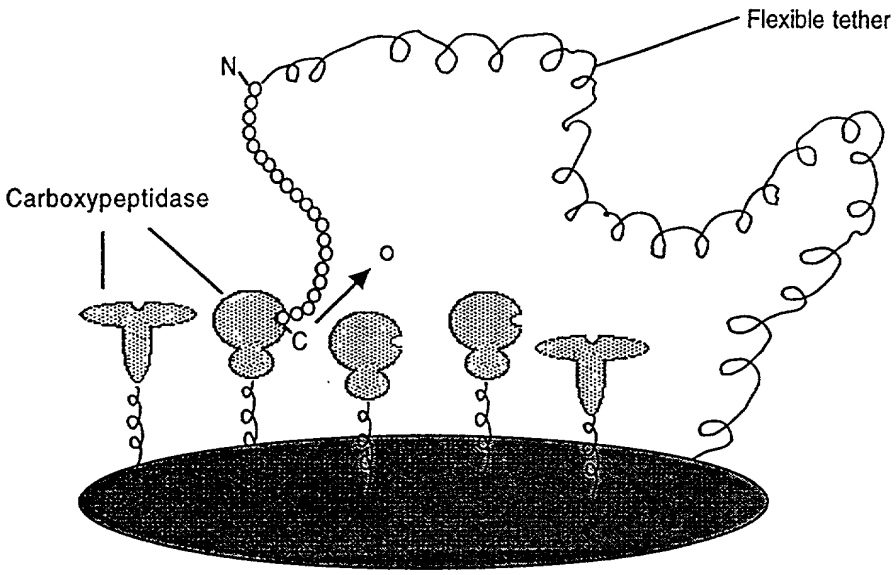


FIG. 18

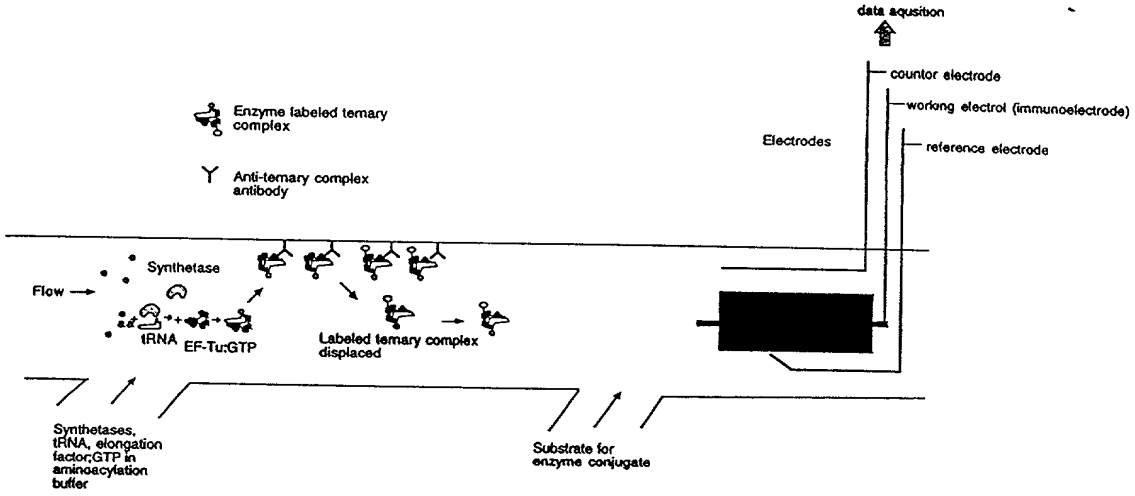


FIG. 19A

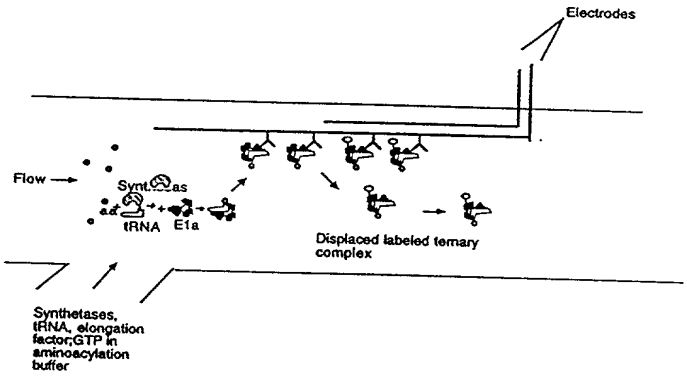


FIG. 19B

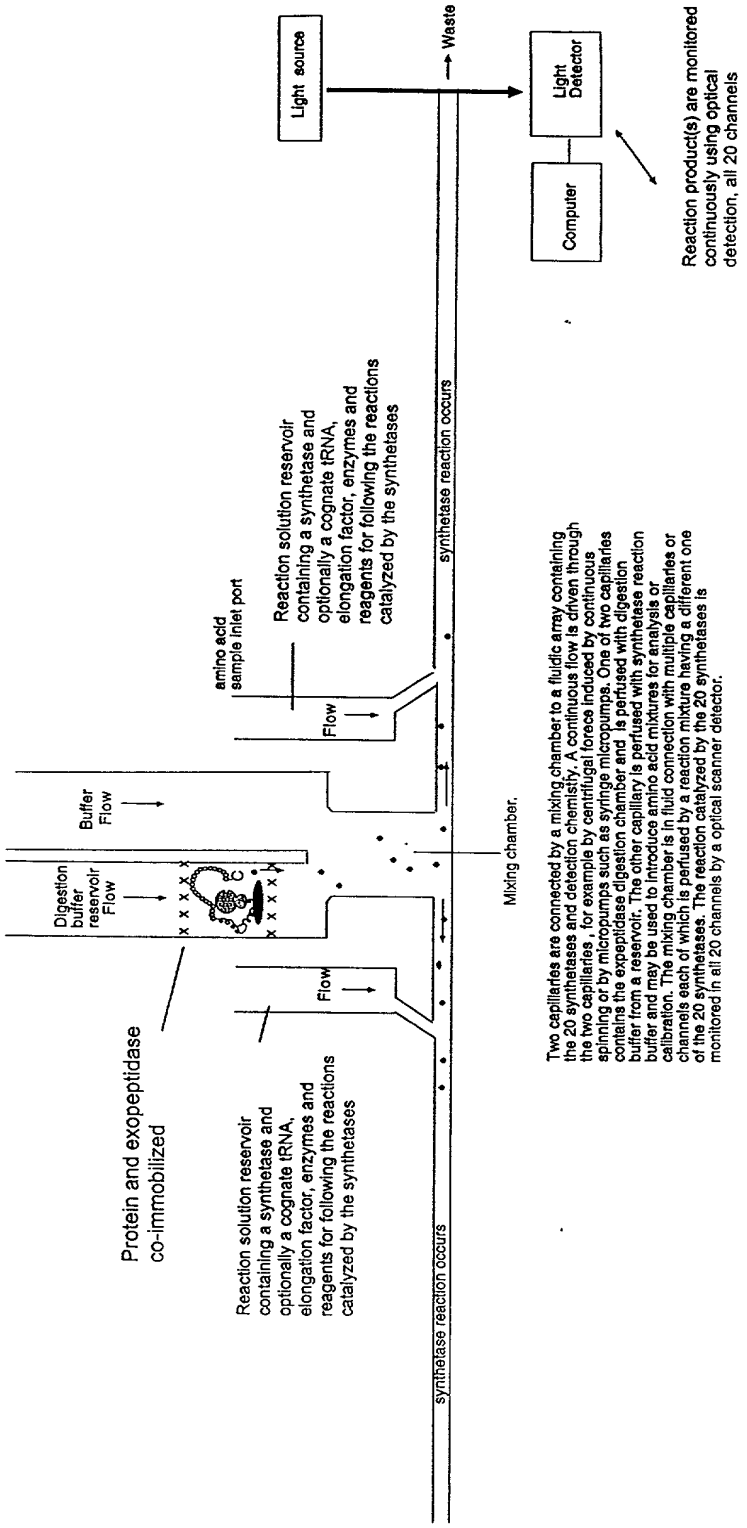

Light source
Waste
Light Detector
Computer
Reaction product(s) are monitored continuously using optical detection, all 20 channels
amino acid sample inlet port
Reaction solution reservoir containing a synthetase and optionally a cognate tRNA, elongation factor, enzymes and reagents for following the reactions catalyzed by the synthetases
Flow
synthetase reaction occurs
Buffer Flow
Digestion buffer reservoir Flow
Mixing chamber.
Protein and exopeptidase co-immobilized
Reaction solution reservoir containing a synthetase and optionally a cognate tRNA, elongation factor, enzymes and reagents for following the reactions catalyzed by the synthetases
Flow
synthetase reaction occurs
Two capillaries are connected by a mixing chamber to a fluidic array containing the 20 synthetases and detection chemistry. A continuous flow is driven through the two capillaries , for example by centrifugal forece induced by continuous spinning or by micropumps such as syringe micropumps. One of two capillaries contains the exopeptidase digestion chamber and is perfused with digestion buffer from a reservoir. The other capillary is perfused with synthetase reaction buffer and may be used to introduce amino acid mixtures for analysis or calibration. The mixing chamber is in fluid connection with multiple capillaries or channels each of which is perfused by a reaction mixture having a different one of the 20 synthetases. The reaction catalyzed by the 20 synthetases is monitored in all 20 channels by a optical scanner detector.

Fig. 20

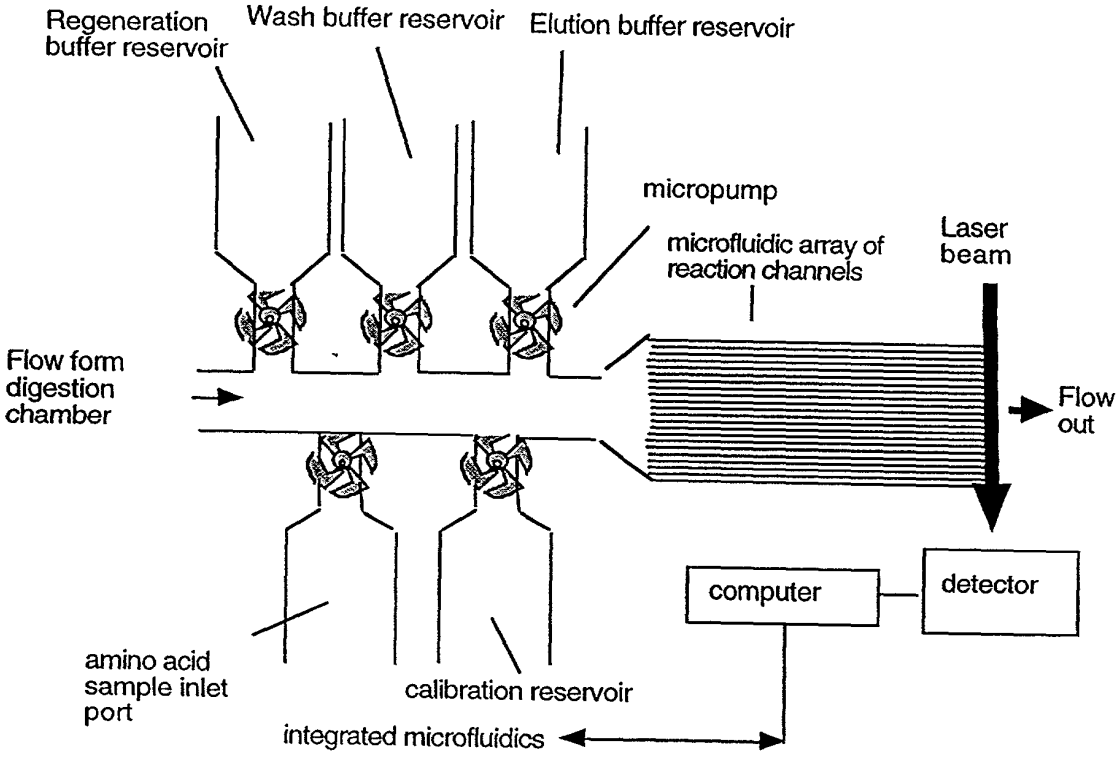


Fig. 21 A

integrated microfluidics

Fig. 21 B

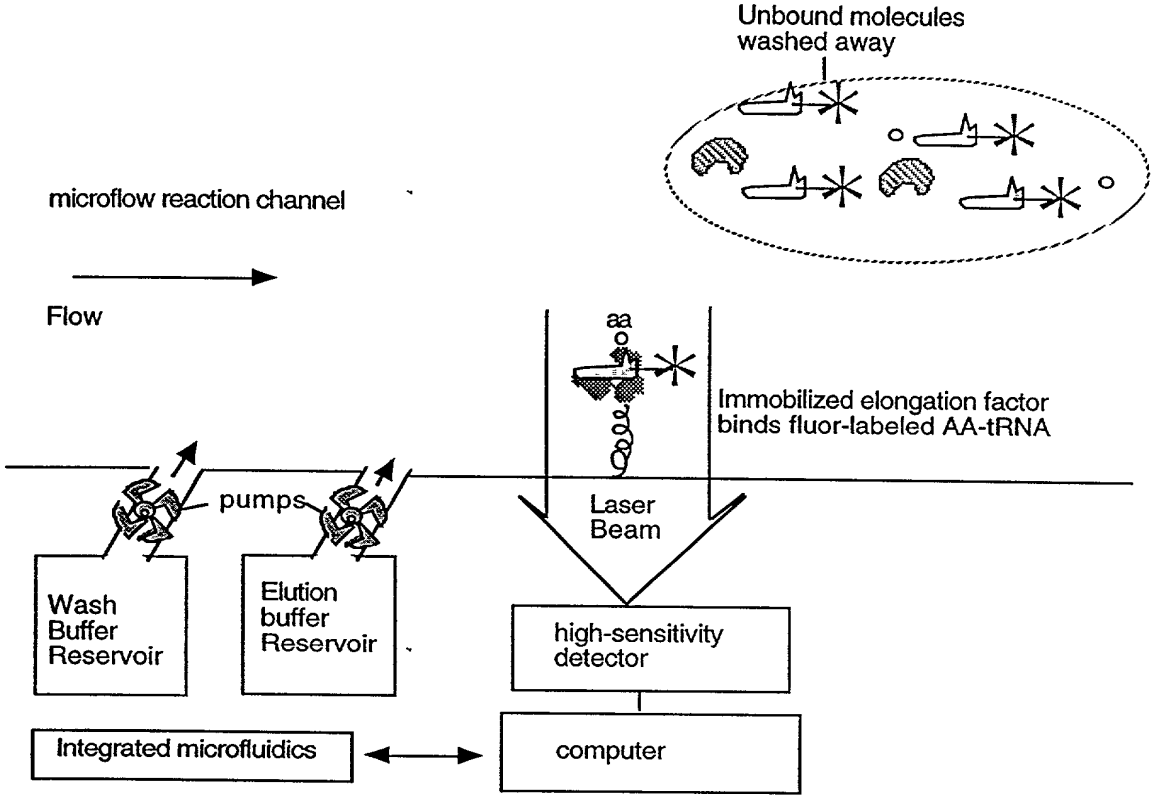
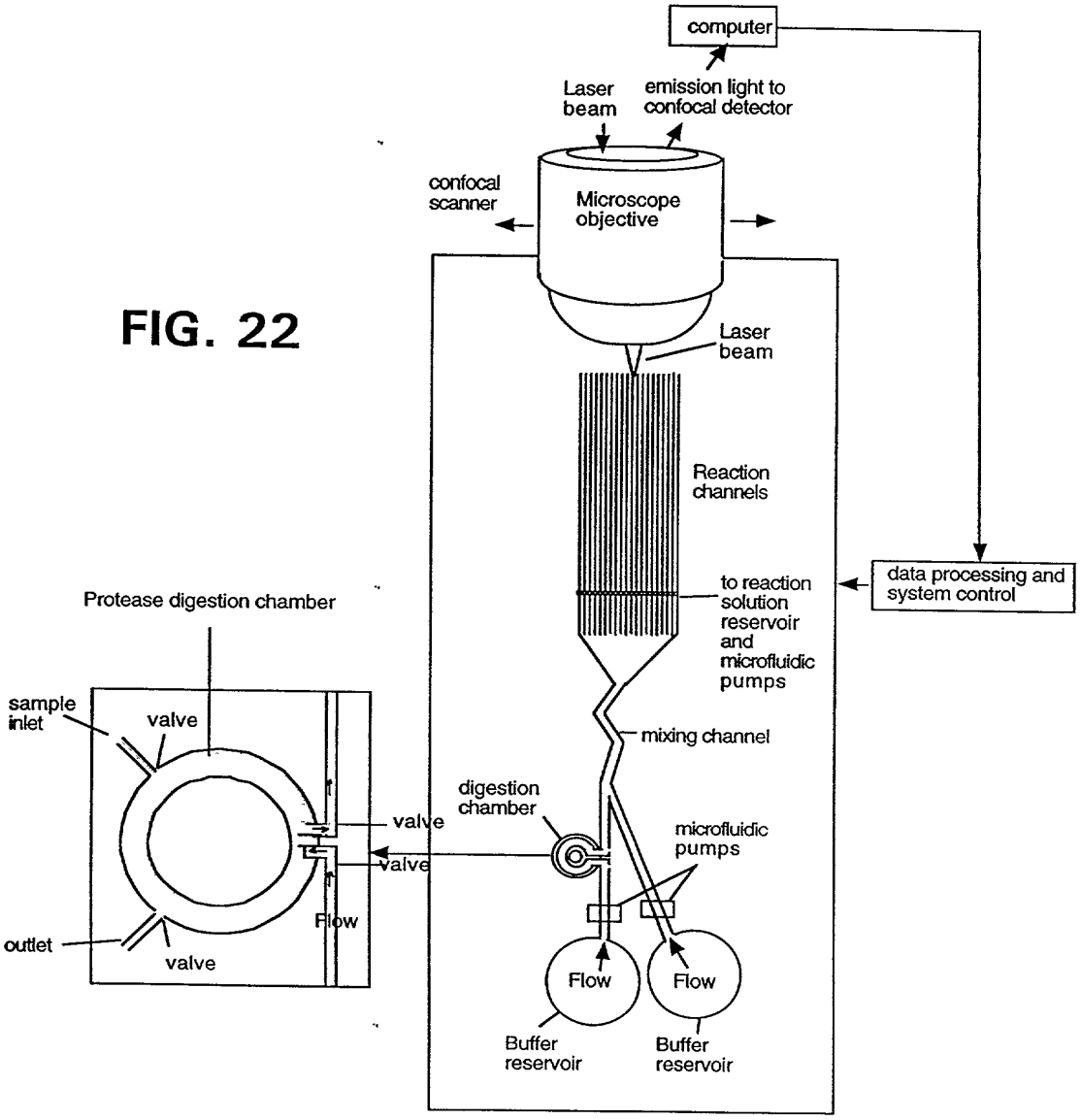

Unbound molecules washed away
microflow reaction channel
Flow
aa
Immobilized elongation factor binds fluor-labeled AA-tRNA
pumps
Laser Beam
Wash Buffer Reservoir
Elution buffer Reservoir
high-sensitivity detector
Integrated microfluidics
computer

FIG. 22


computer
Laser beam
emission light to confocal detector
confocal scanner
Microscope objective
Laser beam
Reaction channels
data processing and system control
to reaction solution reservoir and microfluidic pumps
Protease digestion chamber
sample inlet
valve
mixing channel
digestion chamber
valve
valve
microfluidic pumps
Flow
outlet
valve
Flow
Flow
Buffer reservoir
Buffer reservoir

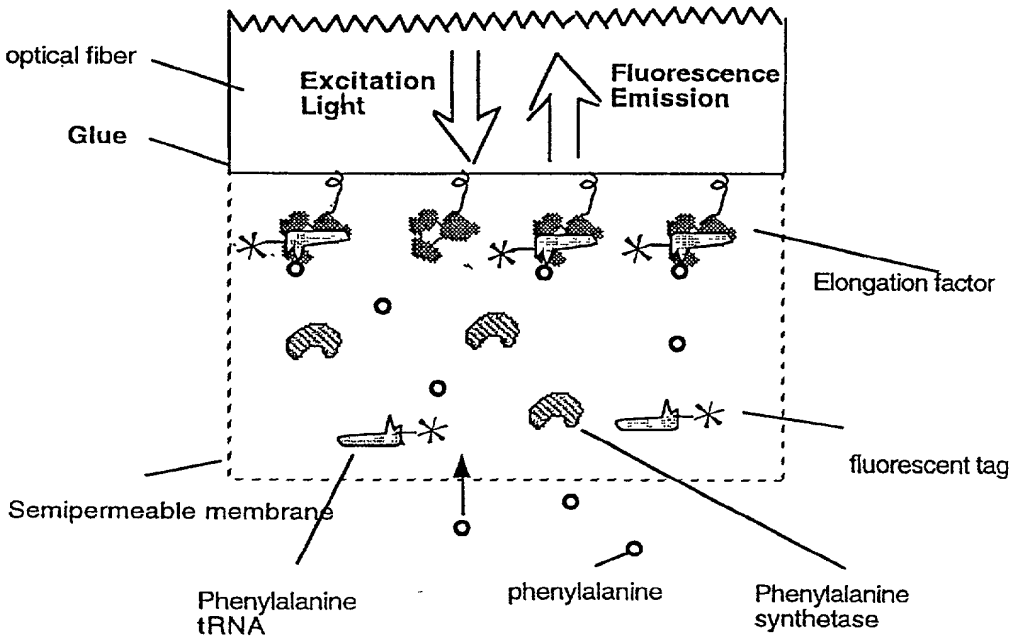
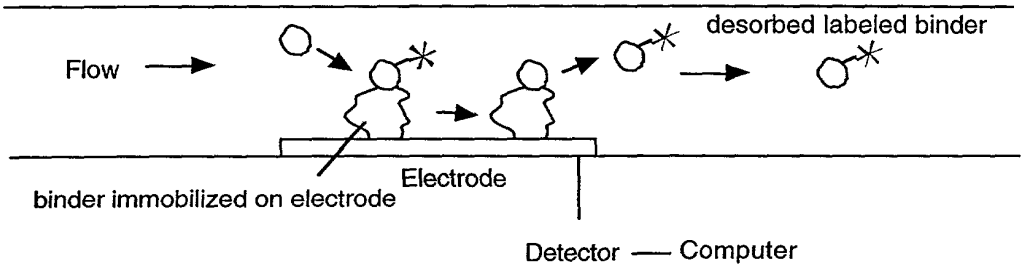

optical fiber
Glue
Excitation Light
Fluorescence Emission
Elongation factor
fluorescent tag
Semipermeable membrane
Phenylalanine tRNA
phenylalanine
Phenylalanine synthetase

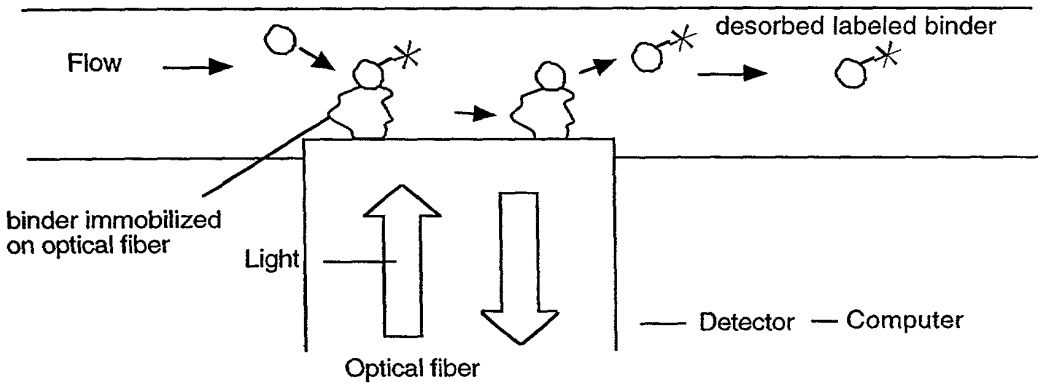
FIG. 23

Biosensors

Using biosensor technology the biospecifically eluted substance may be detected by a change in signal at the transducers surface resulting form the displacement. The following examples illustrate this embodiment of the inventioin. Any of the biosensor technologies may be employed in these embodiments of the invention. Suitable biosensors include but are not limited to surface plasmon biosensors, optical fibers, electrochemical biosensors, and piezoelectric biosensors.



In this embodiment of the invention, the dicrease in signal at the electrode surface is proportional to the eluted labeled molecule.



In this embodiment of the current invention, the decrease in signal at the surface of an optical fiber or optical waveguide bearing the substance having a reversibly bound labeled molecule is proportional to the eluted labeled molecule.